



Department of Health and Human Services
Centers for Disease Control and Prevention



National Program of Cancer Registries – Advancing E-cancer Reporting and Registry Operations (NPCR-AERRO)

**ePath Pilot Project Phase 1: Implementing Electronic
Pathology Laboratory Reporting from a National Laboratory
to State Central Cancer Registries**

Phase 1 Final Report

Advancing E-cancer Reporting and Registry Operations (AERRO) Project
National Program of Cancer Registries (NPCR)
Division of Cancer Prevention and Control (DCPC)
Centers for Disease Control and Prevention (CDC)
Department of Health and Human Services (DHHS)

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Executive Summary

Anatomical pathology laboratory reports, one of the most valuable data sources for cancer registry surveillance, traditionally have been reported in a paper format. Because a manual review process is time-consuming, inefficient, and costly, it would benefit state cancer registries to receive pathology reports securely in a standard electronic format with minimal need for customized technology.

The National Program of Cancer Registries-Advancing E-cancer Reporting and Registry Operations (AERRO) Project conducted an electronic pathology (ePath) Pilot Project to test the implementation of cancer data reporting standards. NPCR-AERRO, previously known as NPCR-MERP, the Modeling Electronic Reporting Project, began as a proof-of-concept project and has expanded to include a variety of modeling, analysis and design, and implementation activities. The project name has been changed to reflect the scope of work more accurately.

Goals of the ePath Pilot Project were to—

1. Implement consistent electronic pathology reporting from a national laboratory to participating state central cancer registries.
2. Provide guidance to state cancer registries and pathology laboratories for implementing electronic pathology reporting in their respective environments.
3. Offer new and improved capabilities for using pathology reports as a cancer information source.

Advantages of this project are to create a single reporting process using existing technological infrastructure and standards, and to provide a unified voice for consistent communication between stakeholders. Successful implementation and lessons learned from this project will build momentum for adoption across the spectrum of pathology laboratories and state cancer registries.

The NPCR-AERRO ePath Pilot Project focused on—

- Creating a Health Level 7 (HL7)¹ message conforming to the North American Association of Central Cancer Registries, Inc. (NAACCR) *Standards for Cancer Registries, Volume V, Pathology Laboratory Electronic Reporting, Version 2.0* and the business rules defined in the *NAACCR ePath Reporting Guidelines*.
- Using the PHIN Messaging System (PHINMS) standard transmission architecture and software because of its cross-platform capability and established use in reporting communicable diseases.
- Adopting or developing software for processing HL7 messages at the registry.

LabCorp, which participates in PHINMS communicable disease reporting, agreed to join the ePath Pilot Project, as did 20 state program registries with the ability and willingness to use PHINMS.

The ePath Pilot Project delivered on all of the following goals—

- 1. Implement consistent electronic pathology reporting from a national laboratory to participating state central cancer registries.**
 - ✓ The pilot group implemented a straightforward data flow as recommended in the *NAACCR Electronic Pathology Reporting Guidelines*.
 - ✓ Use of the NAACCR standards allowed LabCorp to create an HL7 message for each pathology report generated in its laboratory in a timely manner with minimal input from the NPCR-AERRO team.

¹ HL7 Version 2.3.1 is used for this pilot project.

- ✓ PHINMS proved an accurate means of securely transmitting HL7 messages from the laboratory to the participating states.
- 2. Provide guidance to state cancer registries and pathology laboratories for implementing electronic pathology reporting in their respective environments.**
 - ✓ The PHINMS Deployment Team worked with participating states to set up the technical infrastructure needed to receive electronic messages.
 - ✓ The New York Cancer Registry developed a comprehensive plan for managing implementation of electronic pathology reporting in their state.
 - ✓ The NPCR-AERRO Team developed a lessons learned document for PHINMS and state use in future installations.
- 3. Offer new and improved capabilities for using pathology reports as a cancer information source.**
 - ✓ eMaRC Plus is an effective tool for retrieving HL7 messages from a server, validating and parsing the messages, and identifying relevant reports based on a list of search terms. NPCR provided funding for developing this tool. eMaRC Plus is customizable and free to users.

Based on implementation experience, the ePath pilot group also recommended the following changes to standards for reporting cancer registry data—

- The pilot group recommended changes to two areas of the NAACCR HL7 Standard, which the NAACCR Pathology Data Workgroup evaluated and accepted.
- Comparison of the standard Logical Observations Identifiers, Names, Codes (LOINC) with pathology laboratory (local) codes identified a need for LOINC codes specific to anatomic pathology results. Adopting new standard codes will enable laboratories to send the LOINC code in addition to its local code.

Issues that require additional evaluation include—

- Availability of demographic data sufficient to perform linkage with registry data.
- Accurate identification of a report as a cancer case.
- Use of electronic pathology reports in the registry.

NPCR-AERRO is continuing the ePath Pilot Project into a second phase to—

- Transport the process/product to other national laboratories.
- Extend eMaRC Plus functionality to include processing of pathology reports.
- Begin a dialogue with the College of American Pathologists to create a flag indicating whether a pathology report represents a reportable condition.
- Document requirements for accurate processing of electronic pathology reports and actively work with organizations to implement them.

The work performed, knowledge shared, and results gained from the NPCR-AERRO ePath Pilot Project highlight substantial opportunities to improve methods of providing, receiving, and processing pathology data for central cancer registries.

Overview

Anatomical pathology laboratory reports are one of the most valuable data sources for cancer registry surveillance. Approximately 95% of cancer cases reported to the Centers for Disease Control and Prevention's (CDC) National Program of Cancer Registries (NPCR) and the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) Program are confirmed microscopically.² Traditionally, if a cancer registry receives pathology reports, they are usually in a paper format. Certified tumor registrars (CTRs) review paper forms to identify cancer cases. This manual process is very time-consuming. With the advancements of computer technology and the movement toward an electronic medical record, the cancer registry would benefit from receiving pathology reports securely in a standard electronic format.

Problem Statement

The information collected and included in the pathology laboratory reports represents a critical data source for state cancer registries. Currently, states lack the resources either to obtain and process paper pathology reports or to implement their own electronic pathology reporting systems. The need to retrieve data from the pathology report in a more efficient and timely fashion is driving the development of an automated electronic process for accessing and using pathology reports to identify cancer cases.

Purpose

The National Program of Cancer Registries-Advancing E-cancer Registry and Reporting Operations Project (NPCR-AERRO) proposed a pilot project to test the implementation of transmitting electronic anatomical pathology reports from a national laboratory to state central cancer registries. This pilot project will implement electronic pathology reporting using the approved standard in the North American Association of Central Cancer Registries, Inc. (NAACCR) *Standards for Cancer Registries, Volume V, Pathology Laboratory Electronic Reporting, Version 2.0* and the business rules defined in the draft *NAACCR ePath Reporting Guidelines* at <http://www.naaccr.org>.

Objectives

The NPCR-AERRO ePath Pilot Project has the potential to move the cancer registry community forward in using consistent standards for electronic pathology reporting that can improve the completeness, timeliness, and quality of cancer registry data.

Goals

The following goals will help direct the project—

- Implement consistent electronic pathology reporting from a national laboratory to participating state central cancer registries.
- Provide guidance to state cancer registries and pathology laboratories for implementing electronic pathology reporting in their respective environments.
- Offer new and improved capabilities for using pathology reports as a cancer information source.

² Menck H, Deapen D, Phillips J, Tucker T. *Central Cancer Registries: Design, Management and Use, Second Edition*. Dubuque, IA: Kendall/Hunt Publishing Company, 2007.

Specific goals include—

- Testing and documenting the implementation of electronic pathology reporting from a national laboratory to state central cancer registries.
- Identifying and/or developing software needed to implement electronic successful pathology reporting.
- Providing guidance to state central cancer registries and pathology laboratories on the requirements for implementing electronic pathology reporting.
- Integrating and/or referencing the NAACCR ePath Transmission Guidelines³ into the model under development by NCPR-AERRO.

Advantages of a Pilot Project

Several advantages validate the decision to perform a pilot project—

- Develop, test, and implement a single process that will meet the needs of the participating states; the laboratory will not have to accommodate individual state nuances which would overburden it.
- Provide “one voice” to communicate with the laboratory to ensure that a consistent message is maintained.
- Build momentum to work with other national laboratories on implementing ePath reporting to cancer registries.
- Evaluate and implement the Public Health Information Network/National Electronic Disease Surveillance System (PHIN/NEDSS) architecture and tools to allow laboratories and registries to make better use of existing resources.

Project Scope

The project focuses on creating a Health Level 7 (HL7)⁴ message conforming to—

- NAACCR's standard for electronic pathology reporting using HL7 messages.
- NAACCR's electronic pathology transmission guidelines.
- The PHIN Messaging System (PHINMS) standard transmission architecture and software because of its cross-platform capability and established use in reporting communicable diseases.

Project Tasks

The following tasks are defined to meet project objectives—

- Test the business rules defined in the NAACCR ePath Reporting Guidelines.
- Develop and test an HL7 message that is consistent with *NAACCR Standards Volume V, Pathology Laboratory Electronic Reporting, Version 2.0*.
- Review and analyze data transmitted in an HL7 format from LabCorp to ensure it will meet cancer registry data requirements.
- Document issues relating to the *NAACCR Standards Volume V, Pathology Laboratory Electronic Reporting, Version 2.0* and the ePath Business Rules and provide feedback to NAACCR with any modifications and/or enhancements that may be needed.

³ NAACCR Electronic Pathology Reporting Guidelines, 2006:
http://www.naacccr.org/index.asp?Col_SectionKey=7&Col_ContentID=122

⁴ HL7 Version 2.3.1 is used for this pilot project.

- Test the existing PHINMS data transmission software for the secure transmission of messages.
- Identify and test existing data translation and parsing software that will convert data from an HL7 format to the standard NAACCR file format for ePath. This should include the mapping tools that Minnesota and Pennsylvania developed, as well as the NEDSS Program Area Module (PAM) Platform software.
- Identify an HL7 parser tool that is cost-effective, easy to use, flexible, and interoperable with all state systems.

Methods

Laboratory and Central Registry Participation

CDC PHIN has established a working relationship with LabCorp, Quest Diagnostics, and Mayo Medical Laboratories, with LabCorp submitting HL7 messages for communicable diseases to approximately 25 state health departments. NPCR-AERRO identified LabCorp as a national laboratory willing to participate in the ePath Pilot Project.

Central Registry Participation

NPCR-AERRO solicited program registries to obtain project commitment. The ability and willingness to use PHINMS were required.

Twenty states joined the ePath Pilot Project: Alabama, Arizona, California, Colorado, Florida, Georgia, Maryland, Michigan, Missouri, Nevada, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, and Virginia.

Figure 1 depicts the states participating in the ePath Pilot Project.

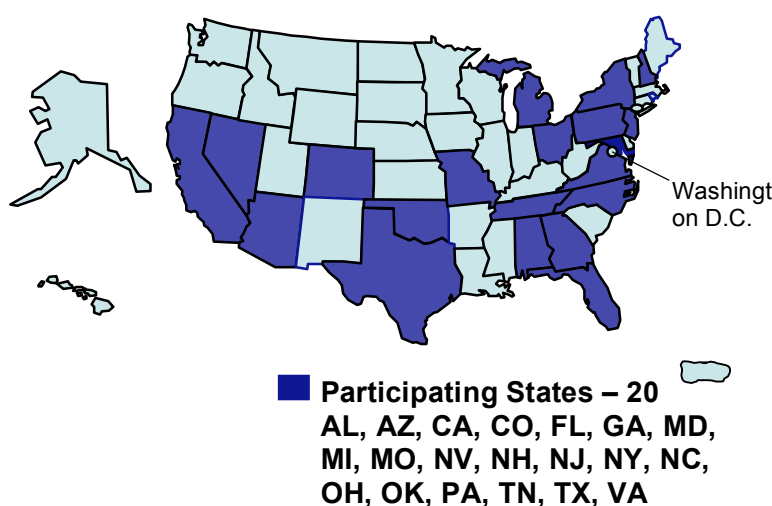


Figure 1: Participating States

Use of PHINMS

The ePath Pilot Project selected PHINMS as the transmission technology. PHINMS runs on virtually all major operating system platforms and is already used by many states for communicable disease reporting.

The CDC NPCR-AERRO technical team collaborated with the CDC PHIN staff to identify the infrastructure in place for electronic laboratory reporting of communicable diseases. NPCR-AERRO compiled information about the existing system infrastructure of each participating state

and helped states develop a list of requirements and timelines for installing and implementing the PHINMS infrastructure (hardware and software).⁵

Participating states worked directly with the PHIN technical support staff to fulfill the requirements before and during implementation. Monthly conference calls were held with LabCorp, participating state health departments and central registries, NPCR-AERRO, and CDC-PHIN to discuss progress, evaluate results, and develop solutions for issues.

Development of an HL7 Message Parser

NPCR-AERRO evaluated the mapper tools developed by the Pennsylvania Cancer Registry and the Minnesota Cancer Surveillance System to evaluate current capabilities and features of existing systems. NPCR funded development of eMaRC Plus software to fit in with the existing suite of cancer registry software products available from NPCR.

Refer to [Appendix B: Message Explanatory Notes for LabCorp](#)

HL7 Segment	Data Element	Problem	Resolution
PID	3: Patient ID	Not always received from ordering client.	LabCorp will report Patient ID when available.
PV1	All data elements	Existing HL7 message that LabCorp is using as a template does not include this segment.	PV1 Segment will not submitted.
ORC	21, 24:	Placement of Facility and Provider Address	See Appendix C.
OBR	16: Ordering Provider	Only the first initial of the first name is reported.	Will include middle name if NPI or UPIN is submitted. If only name is provided, can only include what is provided.
OBR	32: Pathologist Name	Not maintained in a discrete field in the database. LabCorp recommended requirement status be changed to required (R*).	Will be provided with in OBX-5 text. NAACCR will continue to consider this "R". LabCorp will work toward providing this information as a discrete data element in OBR-32.
OBX	2: Value Type	OBX-2 seems to be hard-coded to TX as an explanation of what to find in OBX-5. In certain cases OBX-5 is only a numeric value (such as ICD-9-CM code).	It may be an actual number value, but it is in a comments text field so it has to be TX. Example ICD-9-CM 185. Will remain as TX because LabCorp stores the information as text (in a comments field.)

⁵ Detailed description of PHINMS can be found at <http://www.cdc.gov/phinf/software-solutions/phinfms/>

HL7 Segment	Data Element	Problem	Resolution
OBX	3: Observation Identifier	LOINC codes not always available; some codes are local codes.	LOINC codes will be reported when available. LabCorp's local test code will also be included in OBX-3 as a repeating set of data. A list of LabCorp's local codes and definitions will be provided. LabCorp to LOINC Mapping is available in Appendix C.
OBX	5: Observation Value	Asterisks (*) and extra spaces are included in the observation text results.	Leading spaces have been removed. Extra spaces and asterisks within the text will not be removed. No possibility of change as it will impact the physician's copy of the report.
N/A	General file transmission	Registries don't know whether a lack of a file is due to an error in connection or that there were no reports for that day.	

LabCorp Population of Ordering Provider and Ordering Facility Data Elements

OBR-16: Ordering Provider

ID Number|Physician Name|Designator whether number is NPI or UPIN

ORC-12: Ordering Provider

ID Number|Physician Name| [NO DESIGNATOR]

Note: This data element is not supported in NAACCR. Registries must select information from OBR-16.

ORC-21: Ordering Facility ID

Will always be present.

Note: This is LabCorp's Account ID; must be present so results can be returned.

ORC-22: Ordering Facility Address (ordering physician address within the LabCorp System)

Will always be present.

Note: This is the address for the account; must be present so results can be returned.

ORC-24: Ordering Provider Address

Blank.

LabCorp does not collect the ordering physician's address, only the ordering facility's address.

Scenarios: (The HL7 is a sample only and may not have all components included.)

Scenario #1:

Dr. Jones works for Tiny Town Clinic.

OBR-16: 1234|Jones^Michael|U

ORC-21: Tiny Town Clinic

ORC-22: 1212 Main Avenue^Suite 102^Tiny Town^MN^55101^ etc.

ORC-12: ||

ORC-24: ||

Scenario #2:

Dr. Smith works all by himself.

OBR-16: 1234|Smith^Lincoln|U

ORC-21: Dr. Lincoln Smith

ORC-22: 541 Orchard Street^^Tiny Town^MN^55101^ etc.

ORC-12: ||

ORC-24: ||

Appendix C: Mapping of LabCorp Local Test Codes to LOINC on page 23 and [Appendix D: eMaRC Plus Program Version 1.0.1](#) on page 30.

Results

NPCR-AERRO implemented a straightforward data flow for the ePath Pilot Project similar to that recommended in the NAACCR Electronic Pathology Reporting Guidelines. LabCorp created an HL7 message for each pathology report generated in its laboratory. The messages were grouped into an HL7 batch message and transferred from LabCorp to the state health department or central cancer registry using PHINMS. eMaRC Plus retrieved the batch message, parsed it into individual messages and data element components and subcomponents and loaded the elements into a Microsoft® Structured Query Language (MS SQL) server or Oracle® database. eMaRC Plus evaluated each message and highlighted relevant and negated cancer terms. Figure 2 depicts the data flow.

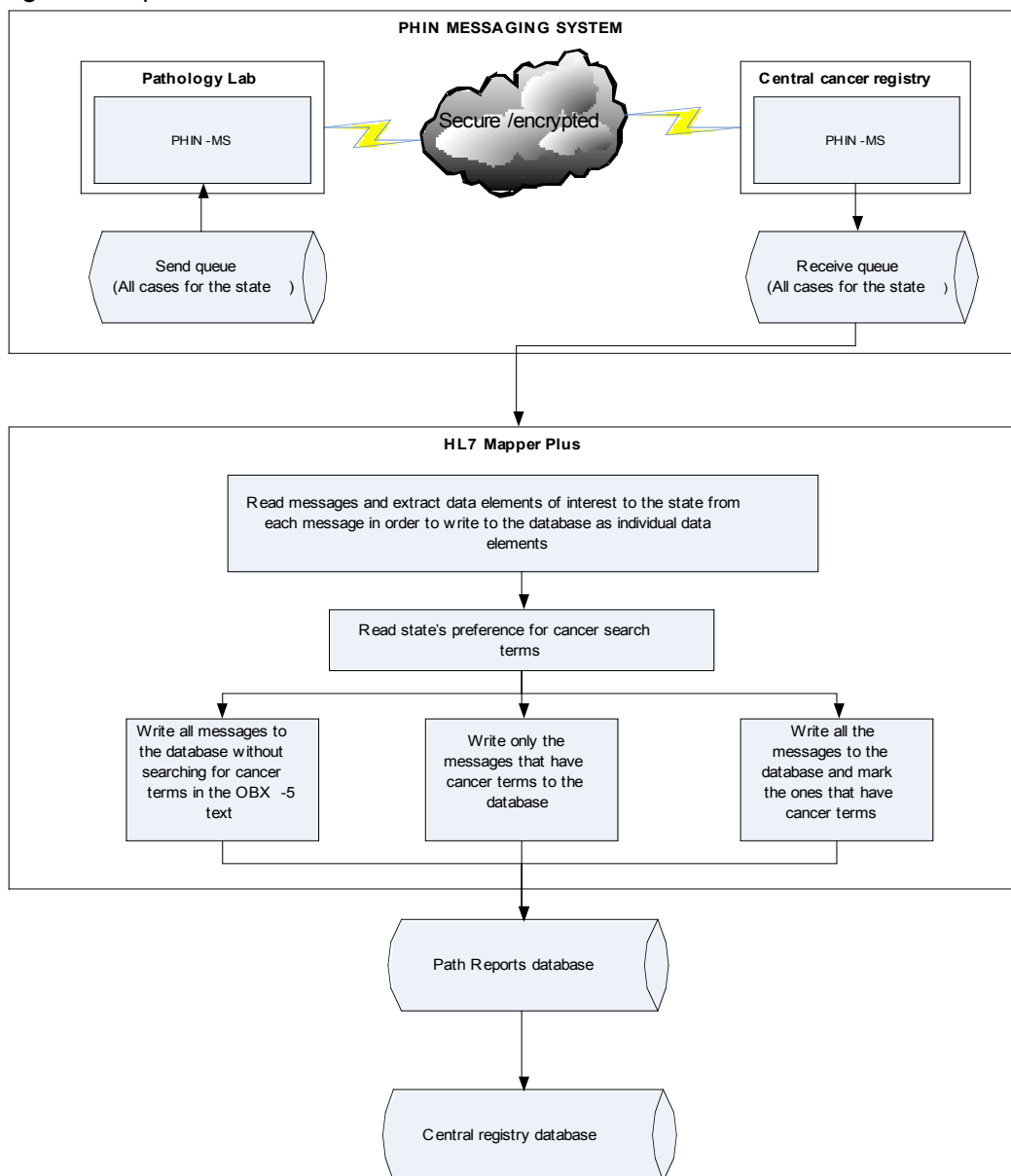


Figure 2: Message Flow

Results and Conclusions - Specific Pilot Project Activities

HL7 Message Creation

The NPCR-AERRO team and the LabCorp representative reviewed the HL7 message specifications described in the *NAACCR Standards Volume V, Version 2.0*, and the NAACCR Guidelines for Electronic Pathology Reporting to identify issues relating to the format, content, or process of creating an HL7 ePath data message. Within the *NAACCR Standards Volume V*, only minimal clarification of data to be reported between the cancer registry community and LabCorp were needed. An example was the clarification of what data was expected to be placed in the Ordering Facility (ORC-21) and Ordering Provider (ORC-12, OBR-16) data elements. Comparing the definitions for these two data elements allowed the data to be placed accurately in the message. The *NAACCR Guidelines* were understood easily and applied by LabCorp with no requests for revision.

Issues relating to HL7 message specifications were resolved in a variety of ways. Of 106 “Required” and “Required if Available” data elements, seven deviations from the standard were implemented. In most instances, deviation from the NAACCR HL7 Standard was due to LabCorp’s database design or because data items were not available. For example, LabCorp does not collect pathologist ID in a discrete data field and therefore could not populate the appropriate HL7 data element. In some instances, the NAACCR Pathology Data Workgroup was contacted to provide additional information and rationale regarding the requirements. A complete list of deviations and resolutions can be found in [Appendix B: Message Explanatory Notes for LabCorp](#) on page 23.

Two areas resulted in a change to the NAACCR HL7 Standard:

The first change is reflected in the instructions for completing a data element whose requirement is R* - Required if available. The original version of the standards stated—

“R* = Required when available; if never available, leave as empty. When data are available, but missing on this instance, use default values as specified in this document.”

At LabCorp’s request, the NAACCR Pathology Data Workgroup evaluated and approved a revision to delete the last sentence from the instruction as it was labor-intensive without providing much benefit. R* data elements that are not present for a particular report may be left empty, regardless of whether the data element is ever populated.

The second change corrected an oversight in not requiring collection of the name of the Ordering Provider, even though his or her address is required.⁶ Instructions have been added to clarify the requirement status of Ordering Provider and Ordering Facility.

The pilot project found that LabCorp uses local codes instead of the standard Laboratory Observation Identifiers Names and Codes (LOINC) coding system for laboratory tests and results in the OBX-3 component because equally specific LOINC codes were not available. Submission of local codes as the only laboratory test code in OBX-3 is not acceptable as it would require registries to create mappings independently for each laboratory’s specific codes. The extensive number of laboratories and the volume of local codes being used preclude development and maintenance of multiple maps.

The ePath pilot project workgroup worked with LabCorp to map the local codes to LOINC codes, using more general LOINC codes when no specific code was available. Both the

⁶ In HL7 2.3.1, these data elements are located in the Common Order Segment (ORC). ORC-12 – Ordering Provider; and ORC-24 – Ordering Provider Address.

mapped LOINC code and the LabCorp local codes are reported in OBX-3. Refer to [Appendix B:](#)

[Message Explanatory Notes for LabCorp](#)

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Will always be present.

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ORC-22: Ordering Facility Address (ordering physician address within the LabCorp System)

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Note: This is the address for the account; must be present so results can be returned.

ORC-24: Ordering Provider Address

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Dr. Jones works for Tiny Town Clinic.

OBR-16: 1234|Jones^Michael|U

ORC-21: Tiny Town Clinic

ORC-22: 1212 Main Avenue^Suite 102^Tiny Town^MN^55101^ etc.

ORC-12: ||

ORC-24: ||

Scenario #2:

Dr. Smith works all by himself.

OBR-16: 1234|Smith^Lincoln|U

ORC-21: Dr. Lincoln Smith

ORC-22: 541 Orchard Street^^Tiny Town^MN^55101^ etc.

ORC-12: ||

ORC-24: ||

Appendix C: Mapping of LabCorp Local Test Codes to LOINC on page 23. NPCR-AERRO is working with three national laboratories to request that more specific LOINC codes be created for anatomic pathology results.

ePath Implementation Standards

The NAACCR standards for transmitting HL7 messages and the guidelines for electronic pathology reporting provide comprehensive and accurate instructions for preparing a standardized electronic pathology report.⁷ Using the NAACCR standards allowed an HL7 message to be created in a very timely manner with minimal input and instructions from the NPCR-AERRO technical team. The NAACCR Pathology Data Workgroup provided active support by responding to questions and agreeing to revisions in two situations. While deviations from the standard did occur, they were due to factors outside the influence of NPCR-AERRO and NAACCR.

The NPCR-AERRO technical team should continue using these documents and provide feedback to NAACCR during its future electronic pathology reporting implementation projects to help keep the standards complete and synchronized with laboratory practices.

PHINMS Implementation

PHINMS proved to be an accurate means of securely transmitting HL7 messages from the laboratory to the participating states. Implementing PHINMS proved to be very complex, requiring extensive staff resources from both PHINMS staff and the participating states. The NPCR-AERRO technical team presented PHINMS as a freely available method for transmitting messages; however, there were costs for implementing PHINMS. Costs incurred seem to reflect availability of hardware and significant information technology (IT) support to perform the implementation.

The New York Cancer Registry developed a comprehensive plan for managing implementation of electronic pathology reporting in their state. The features of this plan include—

- An instruction manual tailored to their specific requirements.
- A Web page for PHINMS information that contained links to pertinent information (e.g., Overview of Architecture and Function, General Executive Summary, Installation and Configuration Instructions, How to Guide, and others).
- An IT staff member who served as the subject matter expert in the PHINMS software and could answer installation questions from laboratories.

Open-source software is used to support the PHINMS. Additionally, Internet Information Services (IIS), also standard software, was used to provide the front-end security.

The PHINMS deployment team provided technical assistance for each cancer registry and was highly committed to getting a configuration implemented and in production. When a registry had difficulties, the deployment team was able to troubleshoot the complexities of this system by accessing the registry's physical PHINMS server remotely or by using the registry's WebEx function.

Selecting the appropriate PHINMS documentation was the most common and frustrating challenge identified during the pilot project. Labor to review and select documentation and follow the complex process through to implementation was significant for all registries. Concise documentation to determine requirements was not available, so ePath Pilot Project participants could not match their IT environment to the PHINMS implementation plan documentation manuals.

The complexity, cost, and process of implementing PHINMS within the registry's IT environment depended directly on whether PHINMS was already in place, was in the implementation phase,

⁷ North American Association of Central Cancer Registries, Inc. (NAACCR) *Standards for Cancer Registries, Volume V, Pathology Laboratory Electronic Reporting, Version 2.0*; NAACCR Electronic Pathology Reporting Guidelines, 2006:

http://www.naaccr.org/index.asp?Col_SectionKey=7&Col_ContentID=122*.

NAACCR Electronic Pathology Reporting Guidelines; December 2006

or needed to be initiated. Maryland and Pennsylvania withdrew from the pilot project because they were not prepared to implement a PHINMS environment within the pilot project timeline. Documentation on assessing adequacy of existing infrastructure was not available; registries proceeded with implementation and later discovered that additional hardware and software would be needed.

Currently there is no automated acknowledgement that a message has been received from the transmitting laboratory. This is a problem in that if there is downtime on either the sender's or the receiver's server, there may be files that are assumed to have been transmitted that never reached the receiver. A mechanism to monitor logs and/or provide feedback on the status of the transmission is needed.

The pilot project selected PHINMS version 2.6 for testing. Service packs and newer versions of PHINMS became available during the pilot project, some of which corrected problems registries were having during implementation. However, the new features in PHINMS 2.7 and 2.7 SP1 were functional upgrades, not bug fixes for PHINMS 2.6.

- The PHINMS deployment team indicated that PHINMS requires a stand-alone server. A configuration of three servers was recommended to house PHINMS in the demilitarized zone (DMZ) and in a separate secured environment, and to store the database.⁸ The new servers required new ports, new static IP numbers, new entries into the Domain Name System (DNS) tables, and a new opening in the firewall.
- Some states had difficulty with their internal IT/network departments in determining the cost of sharing PHINMS hardware and maintenance. While costs will be specific to each installation, registries should evaluate fully whether they will need to contribute financial resources to the maintenance and IT support of the existing PHINMS environment at their institution or department.

The NPCR-AERRO technical team will develop and forward to the CDC PHINMS Management staff a document comprising specific details on implementation provided by the participating states. Based partially on the difficulties experienced by registries in the ePath Pilot Project, PHINMS is making changes that should improve the implementation process.

Future cancer registry implementations of PHINMS should include a full-cost assessment prior to starting the implementation, a standardized installation model, and a more seamless method of handling authentication certificates.

Software for Processing HL7 Messages at the Registry

NPCR-AERRO developed eMaRC Plus as a comprehensive ePath message extraction and parsing software package to process the HL7 files received from the laboratory. eMaRC Plus—

- Polls the PHINMS receiver queue to identify new incoming files.
- Reads an HL7 message batch file and breaks each message into its segments.
- Extracts all of the data elements that have corresponding NAACCR item numbers and names assigned in the *NAACCR Standards Volume V, Version 2.0*.
- Scans the English text data elements (OBX-5) for occurrence of cancer terms.⁹

Note: Depending on the user's preference, messages with no cancer terms are either discarded or marked and saved to the database.

eMaRC Plus is an effective tool for retrieving HL7 messages from a server, validating and parsing the messages, and identifying relevant reports based on a list of search terms. eMaRC

⁸ If the organization does not have a DMZ, only two servers are required: one for the PHINMS software, and one for MS-SQL.

⁹ Pathology report English text is located in the Observation/Result Segment (OBX), specifically OBX-5.

Plus successfully performs all of the tasks identified during the project plan, is customizable, and is freely available for use by registries.

Full documentation of eMaRC Plus can be found in [Appendix D: eMaRC Plus Program Version 1.0.1](#) on page 30. eMaRC Plus can be downloaded from <http://www.cdc.gov/cancer/npcr/tools/registryplus/mp.htm>.

Based on input from the workgroup, the product is undergoing further development to—

- Enhance specificity in text mining.
- Provide a user interface for translating the pathology report into ICD-O-3 topography and morphology codes.
- Export messages to a standard layout format for loading reports to the central registry database.
- Monitor the work queue automatically.

Issues Needing Further Evaluation

Availability of Demographic Data Sufficient to Perform Linkage with Registry Data

Pathology report data is of limited use if registries cannot perform patient linkage accurately. Most registries require a combination of patient's name, Social Security number, birthdate, sex, and sometimes address to determine whether the pathology report matches a case already in the database. Without these fields, limited or no linkage is possible. The lack of ordering provider (physician or facility) information beyond that of the provider name limits the ability to follow back to the provider to obtain full cancer data. Due to volume of pathology reports, many states do not have the resources necessary to follow back to the ordering provider (if available) to get the necessary linkage data items and enter them into a computer system.

Accurate Identification of a Report as a Cancer Case

Registries rely on a variety of text mining methods to determine whether the pathology report has a relevant cancer diagnosis. All require registrar review to eliminate false positive reports.

A possible solution is to add a report flag, completed by the pathologist, to indicate that the record represents a reportable condition.

Use of Electronic Pathology Reports in the Registry

Two general methods exist for using electronic pathology reports. The first method matches the electronic pathology reports to the main database records to identify missing cancer cases. This information is sent back to the facility or provider for reporting the case through a routine process. The second method loads the reportable pathology reports into the main database and is processed similarly to other types of reports.

Evaluation of these methods as it relates to the NPCR-AERRO vision should be considered.

Future Plans

NPCR-AERRO is continuing the ePath Pilot Project into a second phase. Plans for Phase II include the following activities—

- Transport the process/product to other national laboratories.
- Work with national laboratories and LOINC to create standard codes for anatomic pathology.
- Extend eMaRC Plus functionality to include processing of pathology reports.

- Explore and document options for importing electronic reports into central cancer registry systems.
- Begin a dialogue with the College of American Pathologists to initiate a reportability flag for all pathology reports, indicating whether the pathology report represents a reportable condition.
- Document requirements for accurate processing of electronic pathology reports and actively work with organizations to implement them.

As an example, the NPCR-AERRO final report would state that Social Security number and date of birth are requirements for implementing electronic pathology reporting; it would have to note that this goes beyond the NAACCR requirements. The NPCR-AERRO technical team would need to start working actively with pathology associations and laboratories to get their buy-in and participation for providing required data elements on the specimen request form.

- Evaluate Orion® Rhapsody® to identify functions that can be shifted from eMaRC Plus to the state integration broker software (such as retrieving and parsing HL7 messages).

Summary

The work performed, knowledge shared, and results gained from the NPCR-AERRO ePath Pilot Project highlight substantial opportunities to improve methods of providing, receiving, and processing pathology data for central cancer registries. The ePath Pilot Project demonstrated that NAACCR standards can be implemented successfully in a national laboratory that is required to report to multiple registries. It also demonstrated that PHINMS, the transfer tool developed for use by the communicable disease program, can be implemented as effectively in the cancer registration program. Additionally, a software tool for processing the HL7 message from a laboratory was developed and released for use by registries.

Annotated Glossary of Electronic Pathology Components

Component	Definition	Options	Comments
IMPLEMENT- ATION GUIDELINES	Methods, steps, and rules for implementing an electronic pathology reporting (ePath) system.	NAACCR E-Path Guidelines	www.naaccr.org
MESSAGE	Format in which data is recorded.	NAACCR HL7 Standard or NAACCR ASCII Standard	HL7 is recommended; ASCII is an alternate format for submitting data.
SUBMISSION PROCESS	Transfer message between laboratory and registry.	PHINMS	Open source software to transfer any type of file from one entity to another securely.
PARSER	A software application that interprets an HL7 batch message, separating it into individual messages and discrete data elements, which then may be translated, stored in a database, and/or further processed.	NPCR eMaRC Plus or Registry-Specific	Open source software to map the HL7 message to the NAACCR ASCII file format so that the records can be inserted into a database. Registries may choose to use their own existing method of processing the HL7 file so that the records can be inserted into a database.
CASE IDENTIFICATION	Identifies which reports relate to cancer.	NAACCR Search Term List SNOMED CT Codes: 80000–99999 SEER ICD-O-3 Selection Criteria Others: ICD-9, ICD-10, ICD-O-3, Pathologist indicator. Registry-specific	Registries may choose to use their own methods or tools for identifying reports that relate to cancer.

Appendix A: Description of an HL7 Message

Message Segments

The NAACCR *Standards for Cancer Registries Volume V. Pathology Laboratory Electronic Reporting, Version 2.0* establishes the HL7 “**Observation Report-Uninitiated (ORU)**” message as the standard for submitting pathology reports electronically. Each ORU message consists of¹⁰:

- **A Message Header (MSH) segment**, which describes information about the file.
- **A Patient Identifier (PID) segment**, which describes patient characteristics or demographic information.
- **One or more Common Order (ORC) segments**¹¹ describing the characteristics of the test order.
- **One or more Observation Request (OBR) segments** providing information about the results.
- **One or more Observation/Results (OBX) segments**, the results of the test.

Field Components

OBR/ORC segments are reported in pairs, with each pair having one or more OBX results segments. Each segment consists of several fields; a field may be simple (only one component) or complex (multiple components).

A simple data type field contains only one value.

Example:PID-6: Date/Time of Birth

Only one data value is reported in this field: the patient’s birth date and time.

E.g. |19370408| is reported for a patient whose birthday is April 8, 1937.

A complex data type field is divided into components; components, in turn, may be further divided into sub-components if they are of complex data type themselves.

Example:PID-11 Patient Address is a complex field. Included in the one field is the—

- Street Address
- Other Designation
- City
- State or Province
- ZIP or Postal Code
- Country
- Address Type
- Other Geographic Designation
- County/Parish Code
- Census Tract
- Address Representation Code

¹⁰ The ORU message has other segments available; however, they are optional for NAACCR electronic pathology reports and are not discussed here.

¹¹ ORC segment is optional in the NAACCR HL7 message; however, LabCorp provides this segment in its HL7 message to cancer registries.

E.g., |1245 Peachtree Avenue^Apt 4C^Atlanta^Georgia^30341^USA^M^^DeKalb^^A|

Refer to NAACCR *Standards for Cancer Registries Volume V. Pathology Laboratory Electronic Reporting, Version 2.0* for a complete description of the concepts and requirements for reporting pathology reports using HL7.

<http://www.naaccr.org/filesystem/pdf/Standards%20Volume%20V%20Final%20PDF%201-24-06.pdf>

Appendix B: Message Explanatory Notes for LabCorp

HL7 Segment	Data Element	Problem	Resolution
PID	3: Patient ID	Not always received from ordering client.	LabCorp will report Patient ID when available.
PV1	All data elements	Existing HL7 message that LabCorp is using as a template does not include this segment.	PV1 Segment will not submitted.
ORC	21, 24:	Placement of Facility and Provider Address	See Appendix C .
OBR	16: Ordering Provider	Only the first initial of the first name is reported.	Will include middle name if NPI or UPIN is submitted. If only name is provided, can only include what is provided.
OBR	32: Pathologist Name	Not maintained in a discrete field in the database. LabCorp recommended requirement status be changed to required (R*).	Will be provided with in OBX-5 text. NAACCR will continue to consider this "R". LabCorp will work toward providing this information as a discrete data element in OBR-32.
OBX	2: Value Type	OBX-2 seems to be hard-coded to TX as an explanation of what to find in OBX-5. In certain cases OBX-5 is only a numeric value (such as ICD-9-CM code).	It may be an actual number value, but it is in a comments text field so it has to be TX. Example ICD-9-CM 185. Will remain as TX because LabCorp stores the information as text (in a comments field.)
OBX	3: Observation Identifier	LOINC codes not always available; some codes are local codes.	LOINC codes will be reported when available. LabCorp's local test code will also be included in OBX-3 as a repeating set of data. A list of LabCorp's local codes and definitions will be provided. LabCorp to LOINC Mapping is available in Appendix C .
OBX	5: Observation Value	Asterisks (*) and extra spaces are included in the observation text results.	Leading spaces have been removed. Extra spaces and asterisks within the text will not be removed. No possibility of change as it will impact the physician's copy of the report.
N/A	General file transmission	Registries don't know whether a lack of a file is due to an error in connection or that there were no reports for that day.	

LabCorp Population of Ordering Provider and Ordering Facility Data Elements

OBR-16: Ordering Provider

ID Number|Physician Name|Designator whether number is NPI or UPIN

ORC-12: Ordering Provider

ID Number|Physician Name| [NO DESIGNATOR]

Note: This data element is not supported in NAACCR. Registries must select information from OBR-16.

ORC-21: Ordering Facility ID

Will always be present.

Note: This is LabCorp's Account ID; must be present so results can be returned.

ORC-22: Ordering Facility Address (ordering physician address within the LabCorp System)

Will always be present.

Note: This is the address for the account; must be present so results can be returned.

ORC-24: Ordering Provider Address

Blank.

LabCorp does not collect the ordering physician's address, only the ordering facility's address.

Scenarios: (The HL7 is a sample only and may not have all components included.)

Scenario #1:

Dr. Jones works for Tiny Town Clinic.

OBR-16: 1234|Jones^Michael|U

ORC-21: Tiny Town Clinic

ORC-22: 1212 Main Avenue^Suite 102^Tiny Town^MN^55101^ etc.

ORC-12: ||

ORC-24: ||

Scenario #2:

Dr. Smith works all by himself.

OBR-16: 1234|Smith^Lincoln|U

ORC-21: Dr. Lincoln Smith

ORC-22: 541 Orchard Street^^Tiny Town^MN^55101^ etc.

ORC-12: ||

ORC-24: ||

Appendix C: Mapping of LabCorp Local Test Codes to LOINC

LabCorp Test Panel 500918: Pathology Report

LabCorp Specific Results Code	LabCorp Specific Result Code + Abbreviation	LabCorp Full English Name	LOINC Code	Status	NAACCR Data Item Number	NAACCR Data Item Name	Comments
500920	500920 - MATER	Material Submitted	22633-2	Mapped	7420	Nature of Specimen	
500943	500943 - CICD-9	Clinician provided ICD-9:	22637-3	Mapped	7360		LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.
500921	500921 – PREOP	Pre-operative diagnosis:	22636-5	Mapped	7410	Path-Clinical History	
500922	500922 – POSTOP	Post-operative diagnosis:		Mapped	none		
500923	500923 – CLHIST	Clinical history:	22636-5	Mapped	7410	Path--Clinical History	
500937	500937 - OR CON	O/R consult:			none		
500934	500934 – FROSEC	Frozen section diagnosis:			none		
500924	500924 - AMEN RP	Amended report:					No data being reported in this field.
500942	500942 - P DIAG	Preliminary diagnosis:			none		
500927	500927 - F DIAG	Diagnosis:	22637-3	Mapped	7450	Path--Final Diagnosis	
500928	500928 – CMNT	Comment:	22638-1	Mapped	7460	Path--Comment Section	
500925	500925 – ADDEND	Addendum:	35265-8	Mapped	7470	Path--Suppl Reports	
500938	500938 – DIAG	Diagnosis provided by:			N/A		Internal code - will not appear in client pathology reports.

LabCorp Specific Results Code	LabCorp Specific Result Code + Abbreviation	LabCorp Full English Name	LOINC Code	Status	NAACCR Data Item Number	NAACCR Data Item Name	Comments
500929	500929 – SIGNED	Electronically signed:	19139-5	Mapped	7260, 7270, 7290, 7280	Pathologist Last Name, Pathologist First Name, Pathologist Middle Name, Pathologist Name Suffix	
500930	500930 – GROSSD	Gross description:	22634-0	Mapped	7430	Path--Gross Pathology	
500931	500931 – MICROD	Microscopic:	22635-7	Mapped	7440	Path-- Micro Pathology	
500932	500932 – PREVIO	Previous material submitted:					No data being reported in this field.
500935	500935 - SP PRO	Special procedure:			none		
500933	500933 – TRANS	Transcriptionist:			none		
500936	500936 – REPREV	Report reviewed by:			none		
191144	191144 - QA COM	QA comment:			N/A		Internal code - will not appear in client pathology reports.
500940	500940 - PICD-9	Pathologist Provided ICD-9:	22637-3	Mapped	7360	Path--ICD-CM Code	LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.
500941	500941 – CPT	CPT	49560-6	Mapped	7380	Path--CPT Codes	Need to strip last digit off CPT Code.

LabCorp Test Panel 191189: Gyn Report

LabCorp Specific LOINC	LabCorp Specific LOINC + Abbreviation	LabCorp Full English Name	LOINC Code		NAACCR Data Item Number	NAACCR Data Item Name	Comments
191121	191121 – ORDER	Test ordered:			none		
191158	191158 – ASTERI	*****			none		
191108	191108 – DIAGN	DIAGNOSIS:	22637-3	Mapped	7450	Path--Final Diagnosis	
191111	191111 – RECOMM	Recommendation:	22638-1	Mapped	7460	Path--Comment Section	
191109	191109 – ADEQ	Specimen adequacy:			none		
191159	191159 – ASTERI	*****			none		
191154	191154 – SOURCE	Source:	22633-2	Mapped	7420	Nature of Specimen	
191160	191160 - CICD-9	Clinician provided ICD9:	22637-3	Mapped			LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.

LabCorp Specific Results Code	LabCorp Specific Result Code + Abbreviation	LabCorp Full English Name	LOINC Code	Status	NAACCR Data Item Number	NAACCR Data Item Name	Comments
191107	191107 – CLHIST	Clinical history:	22636-5	Mapped	7410	Path--Clinical History	
191124	191124 – AMEND	Amended report:					No data reported in this field.
191110	191110 – COMM	Additional comment:	22638-1	Mapped	7460	Path--Comment Section	
191125	191125 – ADDEND	Addendum:	35265-8	Mapped	7470	Path--Suppl Reports	
191123	191123 – MI	Maturation index:			none		
191112	191112 – PERFOR	Performed by:			none		
191128	191128 - QC REV	QC reviewed by:			none		
191145	191145 – DXPROV	Diagnosis provided by:			N/A		Internal code - will not appear in client pathology reports.
191113	191113 – SIGNED	Electronically signed by:	19139-5	Mapped	7260, 7270, 7290, 7280	Pathologist Last Name, Pathologist First Name, Pathologist Middle Name, Pathologist Name Suffix	
191139	191139 - SP PRO	Special procedure:			none		
191129	191129 – CYHIST	Cytology history:			none		
191144	191144 – COMM	QA comment:			N/A		Internal code - will not appear in client pathology reports.
019018	019018 – COMM	. (management reporting bucket)			N/A		Internal code - will not appear in client pathology reports.
191157	191157 - PICD-9	Pathologist provided ICD9:	22637-3	Mapped	7360	Path--ICD-CM Code	LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.

LabCorp Test Panel 191114: Fine Needle Aspirate

LabCorp Specific LOINC	LabCorp LOINC + Abbreviation	LabCorp Full English Name	LOINC Code		NAACCR Data Item Number	NAACCR Data Item Name	Comments
191131	191131 – SPECTY	Specimen type:	22633-2	Mapped	7420	Nature of Specimen	
191153	191153 – SOURCE	Source:	22633-2	Mapped	7420	Nature of Specimen	
191160	191160 - CICD-9	Clinician provided ICD9:	22637-3	Mapped			LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.
191158	191158 – ASTERI	*****			none		
191136	191136 – DIAG	DIAGNOSIS:	22637-3	Mapped	7450	Path--Final Diagnosis	

LabCorp Specific Results Code	LabCorp Specific Result Code + Abbreviation	LabCorp Full English Name	LOINC Code	Status	NAACCR Data Item Number	NAACCR Data Item Name	Comments
191165	191165 – RECOMM	Recommendation:	22638-1	Mapped	7460	Path--Comment Section	
191142	191142 – COMM	Comment:	22638-1	Mapped	7460	Path--Comment Section	
119159	119159 – ASTERI	*****			none		
191157	191157 - PICD-9	Pathologist provided ICD9:	22637-3	Mapped	7360	Path--ICD-CM Code	LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.
191132	191132 – CLHIST	Clinical history:	22636-5	Mapped	7410	Path--Clinical History	
191134	191134 – AMEND	Amended report:					No data reported in this field.
191135	191135 – ADDEND	Addendum:	35265-8	Mapped	7470	Path--Suppl Reports	
191150	191150 – DXPROV	Diagnosis provided by:			N/A		Internal code - will not appear in client pathology reports.
191137	191137 – SIGNED	Signed out by:			7260, 7270, 7290, 7280	Pathologist Last Name, Pathologist First Name, Pathologist Middle Name, Pathologist Name Suffix	
191138	191138 – PERFOR	Performed by:			none		
191133	191133 – GROSS	Gross description:	22634-0	Mapped	7430	Path--Gross Pathology	
191168	191168 – MICRO	Microscopic description:	22635-7	Mapped	7440	Path-- Micro Pathology	
191143	191143 - SP PRO	Special procedure:			none		
191144	191144 - QA COM	QA comment:			N/A		Internal code - will not appear in client pathology reports.
019018	019018 – COMM	. (management reporting bucket)			N/A		Internal code - will not appear in client pathology reports.

LabCorp Test Panel 191106 Non-GYN Report

LabCorp Specific LOINC	LabCorp LOINC + Abbreviation	LabCorp Full English Name	LOINC Code		NAACCR Data Item Number	NAACCR Data Item Name	Comments
191115	191115 – SPECTY	Specimen type:	22633-2	Mapped	7420	Nature of Specimen	
191152	191152 – SOURCE	Source	22633-2	Mapped	7420	Nature of Specimen	

LabCorp Specific Results Code	LabCorp Specific Result Code + Abbrev	LabCorp Full English Name	LOINC code	Status	NAACCR Data Item #	NAACCR Data Item Name	Comments
191160	191160 - CICD-9	Clinician provided ICD9:	22637-3	Mapped	7360		LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.
191158	191158 – ASTERI	*****			none		
191118	191118 – DIAGN	DIAGNOSIS:	22637-3	Mapped	7450	Path--Final Diagnosis	
191165	191165 – RECOMM	Recommendation:	22638-1	Mapped	7460	Path--Comment Section	
191140	191140 – COMM	Comment:	22638-1	Mapped	7460	Path--Comment Section	
191159	191159 – ASTERI	*****			none		
191157	191157 - PICD-9	Pathologist provided ICD9:	22637-3	Mapped	7360	Path--ICD-CM Code	LabCorp will provide local code and text description to identify clinician vs. pathologist result ICD9-CM code.
191117	191117 – CLHIST	Clinical history:	22636-5	Mapped	7410	Path--Clinical History	
191126	191126 – AMEND	Amended report:					No data reported in this field.
191127	191127 – ADDEND	Addendum:	35265-8	Mapped	7470	Path--Suppl Reports	
191147	191147 – DXPROV	Diagnosis provided by:			N/A		Internal code - will not appear in client pathology reports.
191119	191119 – SIGNED	Signed out by:			7260, 7270, 7290, 7280	Pathologist Last Name, Pathologist First Name, Pathologist Middle Name, Pathologist Name Suffix	Pathologist Name.
191120	191120 – PERFOR	Performed by:			none		
191116	191116 – GROSS	Gross description:	22634-0	Mapped	7430	Path--Gross Pathology	
191156	191156 – MICROS	Microscopic description:	22635-7	Mapped	7440	Path-- Micro Pathology	
191141	191141 - SP PRO	Special procedure:			none		
191144	191144 - QA COM	QA comment:			N/A		Internal code - will not appear in client pathology reports.
019018	019018 - COMM	. (management reporting bucket)			N/A		Internal code - will not appear in client pathology reports.

Appendix D: eMaRC Plus Program Version 1.0.1

Introduction

The eMaRC Plus program reads Health Level 7 (HL7) message batch files, parses messages, and stores various HL7 data elements as discrete field values into tables in the Pathlab database. In a typical setting, the PHIN Messaging System (PHINMS) sends HL7 batch files from a laboratory to a cancer registry or some other agency working on a cancer registry's behalf.

The eMaRC Plus program is installed on a workstation at a cancer registry and polls the worker queue of the PHINMS receiver for any new incoming files. When a new file arrives in the queue, the application identifies and processes the file, and then returns to waiting mode for the arrival of a new file. eMaRC Plus can also be used in an interactive mode where the user can select a file to parse and import into the Pathlab database manually.

During import, depending upon user settings in Configuration, the software checks messages for any cancer terms contained in the OBX-5 texts of the messages, and highlights the terms in a rich text formatted report that are available for user review after the import is complete.

Pathlab Database

eMaRC Plus imports HL7 batch files, parses the messages, and stores HL7 data elements of interest to tables in the Pathlab database. A mapping table called datamap contains the mapping definition of HL7 data elements to fields within tables (refer to the Local Customization section below to see how individual states can use this table to select additional data items for storage).

There are seven data tables, MSH, PV1, PID, ORC, OBR, OBX, and OBXCOMBINEDTEXT, the first six of which correspond to the six segments of the ORU^01 message. HL7 components and subcomponents can be stored individually in the registry database. The hierarchical relationships among segments are maintained in the database.

To simplify processing and use of data, in addition to the OBX table which stores data elements of individual OBX segments as separate records, the text field (OBX-5) of all OBX segments that belong to (are children of) an OBR segment are combined and inserted as one row in the OBXCOMBINEDTEXT table. This table has eight fields to store text of the OBX segments. Depending on the LOINC code that exists in the OBX-3 field, the text of OBX-5 is stored in one of these eight text fields. If OBX-5 texts from multiple OBX segments are mapped to one field, they are concatenated.

The actual messages in the HL7 format are stored in the HL7Messages table.